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FACULTY WORKING PAPER NO. 1358

Monitoring Payables and Receivables

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MONITORING PAYABLES AND RECEIVABLES

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MONITORING PAYABLES AND RECEIVABLES

Abstract

Financial managers are interested in monitoring the performance of receivables and payables with an objective of increasing the speed of cash inflows and reducing the speed of cash outflows. To accomplish this mission, management must understand the relationships that cause changes in accounts receivable and accounts payable. An objective of this paper is to expand Gentry and De La Garza's [8] model for monitoring accounts receivable in order to explain the causes of changes in payables. Several examples are developed to show the operation of the model. The primary contributions of the paper are the algorithms that measure the causes of changes in the two working capital components; and the interpretation of the relationships that link changes in sales and purchases to the respective collection and payment patterns which result in causing receivables and payables to change. The model should be of value to financial managers, financial analysts and academic researchers interested in the underlying causes of changes in the amount and timing of cash flows.

MONITORING WORKING CAPITAL COMPONENTS

Tracking the amount and timing of a firm's cash inflows and outflows is a primary task of financial managers and analysts. When analyzing the causes of changes in the level and speed of cash inflows and outflows, management and analysts monitor changes in accounts receivable and accounts payable vis-a-vis changes in sales and purchases of raw materials. There are numerous finance oriented models that focus on the control of accounts receivable, e.g., [1, 2, 3, 4, 5, 7, 8, 10, 11, 13, 14, 15, 18]. However, the literature related to managing and controlling accounts payable is found in leading textbooks such as [6, 12, 16]. Understanding the relationships that exist between receivables and sales and between payables and purchases provides the base for predicting and controlling cash inflows and outflows.

Conceptually, changes in receivables and payables are directly related to a firm's cash inflows and outflows, therefore, changes in their performance directly affects the value of the firm [9, 17]. A model that determines the causes of change in receivables and payables would provide valuable information in explaining changes in the value of a firm. A primary objective of this paper is to develop such a model. The paper extends the generalized model for monitoring accounts receivable developed by Gentry and De La Garza (GD) [8]. Objectives of this paper are to present a matrix of conditions that are responsible for changes in accounts payable; to create a model that identifies and measures the causes of changes in payables; to interpret functional relationships between independent cash flow variables that cause changes

in payables and receivables and, finally, to show the contribution of this information in managing the receivables and payables.

Payables Behavior

GD identified seven sets of conditions that were needed in order to analyze changes in accounts receivable. These conditions were conceptualized in a 3x3 matrix based on the trend of sales patterns (S) and collection experience (CE). Exhibit 1 is a similar 3x3 matrix used to identify the conditions that cause changes in payables. The horizontal axis represents changes in payables due to changes in purchasing patterns. Changes in purchases are in turn related to changes in a firm's demand for a supplier's products. The vertical axis reflects changes in payables related to the firm's payment experience. These changes in payment experience are in turn related to changes in the supplier's credit policies or the firm's own internal payment policies.

Changes in the purchasing patterns refer to changes in the level of purchases occurring on a month-to-month basis. The pattern and trend in purchases can change because of seasonal, cylical or random events. The firm's payment experience reflects its relationship with the supplier, the credit terms and the collection behavior of the supplier. Payment experience is characterized by the fraction of credit purchases in a month that remain outstanding at the end of a subsequent month. For example if the payment pattern for December is 80-25-5; it means 80% of December's purchases are outstanding as payables on December 31;

25% of November's purchases are outstanding as payables on December 31; and 5% of October's purchases are outstanding on December 31.

An overview of the seven conditions shown in Exhibit 1 provides the logic for the payable's algorithm. In Condition 1, payables do not change because there is no change in the purchasing patterns or the payment experience. Under Condition 2, 100% of the change in payables is associated to a change in payment experience. For example, payables can increase because of lienient collection practices of suppliers or the firm stretches payments beyond the due date to its suppliers. Condition 2 is a lengthening of the payment pattern which is a benefit because the firm is able to extend its use of the supplier's trade credit without any explicit cost for the use of the funds. This extension has no affect on purchases. Alternatively, under Condition 2', payables can decrease because suppliers tighten their collection practices or a firm pays before the due date. The result is a reduction in a firm's payment experience which has a cost because full utilization was not made of the credit period. This reduction has no affect on the firm's purchasing patterns.

Condition 3 is the opposite extreme of Condition 2, where 100% of the change in payables can be attributed to a change in the demand for goods from suppliers. Condition 3 reflects an increase in payables caused by an increase in purchases. Under Condition 3', there is a decrease in payables that is solely associated with a decrease in purchases. In Condition 3 or 3', the increase or decrease in payables did not affect supplier credit terms and/or collection behavior.

Condition 4 depicts the case where payables increase because of lenient collection practices by suppliers or the firm receiving credit stretches on its payments. These practices have a spillover effect on purchases which, in turn, is responsible for an increase in payables. Simultaneously, an increase in the demand for supplier goods contributes to an increase in purchases. The demand for additional supplier goods results in a further increase in payables, which can spillover and cause a further relaxation in collection practices by suppliers or a stretching of the firm's payments, i.e., a lengthening in payment experience. In summary, an increase in payables can be a combination of a pure purchasing effect, a pure payment effect and a joint interaction effect between purchases and payment. Under Condition 4, we observe that both the purchasing pattern effect and the payment experience effect are so positioned as to cause payables to increase. An example of Condition 4 is a manufacturer that experiences an increase in demand and in turn expands its purchases from the supplier. The supplier responds by relaxing collection practices because of increased business and allows the manufacturer to delay payment for the goods. Or alternatively, a supplier relaxes its collection policies which encourages a manufacturer to increase the size and/or frequency of its orders for goods. The result of these two examples is an increase in payables attributable to three effects--purchasing, payment and joint.

The circumstances under Condition 5 are opposite those in Condition 4. A tightening of collection procedures by a single dominant supplier may result in the manufacturing firm having to accelerate its payments for the goods received. At the same time, the firm may reduce its

purchases from the supplier because of the shortened credit period or alternatively, it may either substitute a lower cost alternative product or reduce the need for the supplier's product. Because both payment experience and purchasing patterns are positioned to cause payables to decline, we observe that a segment of the decrease in payables is caused by a joint interaction between payment experience and purchases. The interaction of more rapid payment and declining purchases creates a joint effect. Thus under conditions of tightened credit practices from a supplier, we are likely to observe payables declining because of a reduction in payment experience, a reduction in purchases and a joint effect.

Under Condition 6 and 7, opposite forces are interacting that create a moderating influence. Under Condition 6, purchases are down because of a decline in sales which results in lower payables, but lenient collection practices by the supplier cause payables to decline less rapidly than purchases or possibly to increase. These are opposing interaction effects between the two forces. The size and direction of the change in the payables is dependent on whether the decline in purchases has greater effect than the lengthened payment experience. Under Condition 7, tightened credit practices result in lower payables, but increased demand causes purchases to increase. As in Condition 6, there are opposing interaction effects with the payment experience causing the change in payables to increase less rapidly than the purchases or possibly to decline. The size and direction of the change in payables depends on whether the increase in purchases is more prominent than the influence of the tightened

collection practices of the supplier. In summary, from the perspective of the accounts payable manager and taking into account the purchase, payment and joint effects, Condition 4 is the most attractive outcome of the seven scenarios in Exhibit 1 and Condition 5 is the least preferred outcome.

Payables Model

Using the GD model as an anchor, we developed separate algorithms for measuring the purchasing pattern effect (PPE), the payment experience effect (PEE), and the joint effect for payables (JEP) for each of the seven conditions. The algorithm for each condition is presented in Exhibit 2. Examples are developed in Exhibit 3 to show the operation of each algorithm and to determine the contribution of the PPE, PEE and JEP to the changes in payables. The information used in each of the examples is in Exhibit 3.

Exhibit 3 shows there has been a $7 million increase ($78 million - $71 million) in payables between months 3 and 6. What was the contribution of the purchasing, payment and joint effects to the $7 million change in payables? The example shows the payables in month t are composed of current purchases in month t and purchases made in the two preceding months, t-1 and t-2. To calculate the contributions to payables for months t, t-1 and t-2, it is necessary to multiply the purchases in month t times the payment pattern in that month and repeat the process for months t-1 and t-2. That is, the $71 million in payables in month 3 is composed of $40 million from month t ($80 million x .50), $22 million from month t-1 ($110 million x .20) and $9 million from month t-2 ($90 million x .10).

To calculate the separate effects causing changes in payables, it is necessary to determine the value that months t, t-1 and t-2 contribute to the total payables in month t. The first step is to determine the change in purchases that occurred between period t-2 in month 3 and period t-2 in month 6. Exhibit 3 shows purchases decreased $10 million ($80 million - $90 million) and the payment pattern was unchanged at .10. This decrease was caused by a decline in purchases, or a purchasing pattern effect (PPE), which is Condition 3 in Exhibit 2. The next step is to determine the contribution of period t-1 to total payables in month t. Exhibit 3 shows there was no change in purchases or payment patterns which is Condition 1. Finally the contribution month t makes to total payables is a lengthening in the payment pattern from .5 to .6 between months 3 and 6 and no change in purchases, which is Condition 2. Using the respective algorithm for each condition, the contribution of each time period to the total payables is shown in Exhibit 4.

Exhibit 4 shows the $7 million increase in payables between months 3 and 6 was caused by an $8 million lengthening in the payment experience of the firm and a decrease in purchases which reduced payables by $1 million. When the two effects are combined, they equal the $7 million ($8 million - $1 million) change in payables. In a relative context, the payment experience effect contributed 114.28% (8/7) of the change in payables between months 3 and 6, while purchasing contributed a -14.28% (- 1/7) to the change in payables.

Exhibit 4 presents an example that determines the contribution of the PPE, PEE and JEP effects that cause a $4 million increase in payables between months 3 and 9. The information from months 3 and 9 that is used in the algorithms for Conditions 4, 5 and 6 is presented in Exhibit 3. The Condition 4 algorithm is used to determine the causes of the changes in payables between period t-2 for months 3 and 9. The Condition 6 algorithm is used to solve for the causes of change in payable effects for period t-1 in months 3 and 9 and the Condition 5 algorithm is used for period t in months 3 and 9. Exhibit 4 summarizes the results which shows the purchasing pattern effect was $-7 million ($1, $-4 and $-4 million for the respective periods); the payment experience pattern was $11 million ($9, $9 - $7 million for the respective periods) and the joint effect of zero ($1 million in t-2 and $-1 million in t). Thus the payment effect contributed -175% (-7/4 million) of the $4 million change in payables between periods 3 and 9 and 275% (11/4) was attributed to the payment experience pattern.

There was an $11 million reduction in payables between the third and twelfth months. Exhibit 4 shows Condition 7 explains the change in payables for period t-2 and t and Condition 3 for period t-1. The payment effect contributed a -172.72% (-19/11) of the $11 million decline in payables, while the purchasing experience offset a +72.72% of the decline. These examples show that there are periods when the purchasing, payment and joint effects cause payables to increase and, alternatively, the same three effects cause payables to decrease. Understanding this phenomenon provides insights for management and financial analysts.

Interpreting Relationships

Although the algorithms for determining the cause of changes in payables and receivables[1] have been presented and interpreted, our final objective is to establish a solid grounding of the key relationships that underlie the analysis. Exhibit 5 is an extension of the original matrix in Exhibit 1 and shows graphically how changes in accounts payable (ΔAP) are caused by changes in purchases (ΔP) and payment experience (ΔPE) and how changes in accounts receivable (ΔAR) are related to changes in sales (ΔS) and changes in collection experience (ΔCE). A brief explanation of Exhibit 5 will assist the interpretation of these key relationships.

In Cell 1 of Exhibit 5, we observe no change in either of the working capital components, because there is no change in any of the independent or dependent variables. That is, the slope in accounts payable (ΔAP) is zero because the change in purchases (ΔP) and payment experience (ΔPE) are zero.

In Cell 2 of Exhibit 5 the slope of P and S are unchanged from the previous period, therefore, the increase in the trend of AP and AR is caused by the lengthening of the payment experience (ΔPE) and the deterioration in the collection experience (ΔCE), respectively. Cell 2' reflects no change in P or S, but a reverse set of conditions for payment and collection experience causes the trend of the two working capital components to decrease. From the perspective of monitoring accounts payable and observing a slowdown in outflows, Cell 2 provides better performance results than Cell 2'. However, from the

perspective of monitoring accounts receviable, Cell 2' produces superior receivables turnover resulting from more rapid cash inflows.

Exhibit 5 shows Cell 3 as the case where payment and collection experience are unchanged from the previous period. However, purchases and sales are increasing thereby causing an upward slope to AP and AR. Cell 3' reflects the opposite condition where P and S are decreasing and are solely responsible for a decreasing trend in AP and AR.

Cell 4 in Exhibit 5 is an example of payables and receivables increasing more rapidly than the increase in purchases and sales. The reason the two working capital components are increasing more rapidly than the ΔP and ΔS, respectively, is that there has been a slow down in payments and a deterioration in collections, plus the accompanying joint interaction effects. The opposite set of conditions exist in Cell 5 where the decreasing trend of AP and AR is more rapid than the respective changes in P and S because of a speedup in payment and an improvement in collection experience effects and the accompanying joint interaction effects. In monitoring accounts payable, Cell 4 provides the best cash outflow performance of the nine cells and Cell 5 has the least attractive outflow performance.

Cell 6 reflects the set of conditions where purchases and sales declined, while payment experience was lengthened and collection experience deteriorated. The trends of P and S are decreasing as observed in Exhibit 5, but because of the PE and CE effects, the trend of AP and AR declined less than P or S, respectively. Finally, from the perspective of monitoring the performance of receivables and

speeding up the inflow of cash, Cell 6 is inferior to any of the other eight cells.

Because of a speedup in payment experience and the improvement in collection experience, Cell 7 shows the trendlines for AP and AR are not increasing as rapidly as their counterpart variables, P and S. From the perspective of monitoring the performance of receivables and improving the timing and amount of cash inflow, Cell 7 is superior to any of the other eight cells in the matrix.

Exhibit 5 provides a useful framework for financial managers, analysts and academic researchers to identify quickly the sets of conditions and variables responsible for changing the cash convertibility trend of AP and AR. As indicated the cells in Exhibit 5 highlight the location as to where the worst sets of conditions exist for increasing AP and AR, as well as the best set of conditions. Using the cash conversion cycle as a benchmark, the best set of conditions for payables are in the top row of Exhibit 5 and the best set of conditions for receivables is the bottom row of Exhibit 5.

Conclusion

The model developed can be used to measure and analyze the conditions that cause changes in payables and receivables. The respective relationships that exist between purchasing and sales vis-a-vis payment and collection experience patterns are the foundations for the algorithms. Exhibit 5 provides a useful framework for financial managers, analysts and academic researchers to analyze the causes of changes in payables, receivables, cash flow and value of the firm.

Footnote

[1]The algorithms for receivables are in Exhibit 2 of GD [8].

References

1. W. Beranek, Analysis for Financial Decisions, Homewood, IL, Richard D. Irwin, 1963.

2. M. D. Carpenter and J. E. Miller, "A Reliable Framework for Monitoring Accounts Receivable," Financial Management (Winter 1979), pp. 37-40.

3. R. M. Cyert, H. J. Davidson, and G. L. Thompson, "Estimation of Allowance for Doubtful Accounts by Markov Chains," Management Science (April 1962), pp. 287-303.

4. R. M. Cyert and G. L. Thompson, "Selecting a Portfolio of Credit Risks by Markov Chains," Journal of Business (January 1968), pp. 39-46.

5. L. P. Freitas, "Monitoring Accounts Receivable," Management Accounting (September 1973), pp. 18-21.

6. G. W. Gallinger, Liquidity Analysis and Management, Reading, MA, Addison-Wesley Publishing Company, 1987.

7. G. W. Gallinger and A. J. Ifflander, "Monitoring Accounts Receivable Using Variance Analysis," Financial Management (Winter 1986), pp. 69-76.

8. J. A. Gentry and J. M. De La Garza, "A Generalized Model for Monitoring Accounts Receivable," Financial Management (Winter 1985), pp. 28-38.

9. J. A. Gentry and H. W. Lee, "An Integrated Cash Flow Model of the Firm," Faculty Working Paper No. 1314, Bureau of Economic and Business Research, University of Illinois, December 1986.

10. N. C. Hill and K. D. Riener, "Determining the Cash Discount in the Firm's Credit Policy," Financial Management (Spring 1979), pp. 68-73.

11. J. D. Kallberg and A. Saunders, "Markov Chain Approaches to Analysis of Payment Behavior of Retail Credit Customers," Financial Management (Summer 1983), pp. 5-14.

12. Donald E. Kieso and Jerry J. Weygandt, Intermediate Accounting, Fourth Edition, New York, John Wiley & Sons, 1983.

13. G. H. Lawson, "The Mechanics, Determinants and Management of Working Capital," Managerial Finance (No. 3/4 1984), pp. 12-25.

14. W. D. Lewellen and R. W. Johnson, "Better Way to Monitor Accounts Receivables," Harvard Business Review (May-June 1972), pp. 101-109.

15. W. D. Lewellen and R. O. Edmister, "A General Model for Accounts Receivable Analysis and Control," Journal of Financial and Quantitative Analysis (March 1973), pp. 195-206.

16. W. B. Meigs, A. N. Mosich and C. E. Johnson, Intermediate Accounting, Fourth Edition, New York, McGraw Hill Book Company, 1978.

17. W. L. Sartoris and N. C. Hill, "A Generalized Cash Flow Approach to Short-Term Financial Decisions," Journal of Finance (May 1983), pp. 349-360.

18. B. K. Stone, "The Payment Pattern Approach to Forecasting and Control of Accounts Receivable," Financial Management (Autumn 1976), pp. 65-82.

Exhibit 1

Sets of Conditions Responsible for Changes in Payables

		Purchasing Patterns (P)		
		UP(↑)	No Change (NC)	Down(↓)
Payment Experience (PE)	Lengthening (↑)	4	2	6
	No Change (NC)	3	1	3'
	Reducing (↓)	7	2'	5

Exhibit 2

Algorithms for Measuring the Pattern Effects
That Cause a Change in Payables

Condition	Description	Type of Effects	Algorithm
1	NC in PE or P	None	
2, 2'	↑ or ↓ in PE and NC in P ($P_j = P_i$)	PEE	$\Delta PE \times P_i$
3, 3'	↑ or ↓ in P and NC in PE	PPE	$\Delta P \times PE_i$
4	↑ in PE and ↑ in P	PPE	$\Delta P \times PE_i$
		PEE	$\Delta PE \times P_i$
		JEP	$\Delta P \times \Delta PE$
5	↓ PE and ↓ in P	PPE	$\Delta P \times PE_j$
		PEE	$\Delta PE \times P_j$
		JEP	$-\Delta P \times \Delta PE$
6	↑ in PE and ↓ in P	PPE	$\Delta P \times PE_i$
		PEE	$\Delta PE \times P_j$
7	↓ in PE and ↑ in P	PPE	$\Delta P \times PE_j$
		PEE	$\Delta PE \times P_i$

Legend

P = Purchasing Patterns
PE = Payment Experience
NC = No Change
↑ or ↓ = See Exhibit 1
i = Oldest Month
j = Current Month
PPE = Purchasing Pattern Effect
PEE = Payment Experience Effect
JEP = Joint Effect for Payables

Exhibit 3

Four Months of Information Used to Determine Payables
and the Separate Effects Causing Them to Change
(In Millions of Dollars)

Month Representing Period t (1)	Three Months Included in Payables (2)	Purchases (3)	Payment Patterns (4)	Monthly Contribution to Payables in Period t (5) = (3)x(4)	Total Accounts Payable in Month Sum of Col. 5 (6)
	t-2	90	.10	9	
	t-1	110	.20	22	
3	t	80	.50	40	71
	t-2	80	.10	8	
	t-1	110	.20	22	
6	t	80	.60	48	78
	t-2	100	.20	20	
	t-1	90	.30	27	
9	t	70	.40	28	75
	t-2	100	0	0	
	t-1	100	.20	20	
12	t	100	.40	40	60

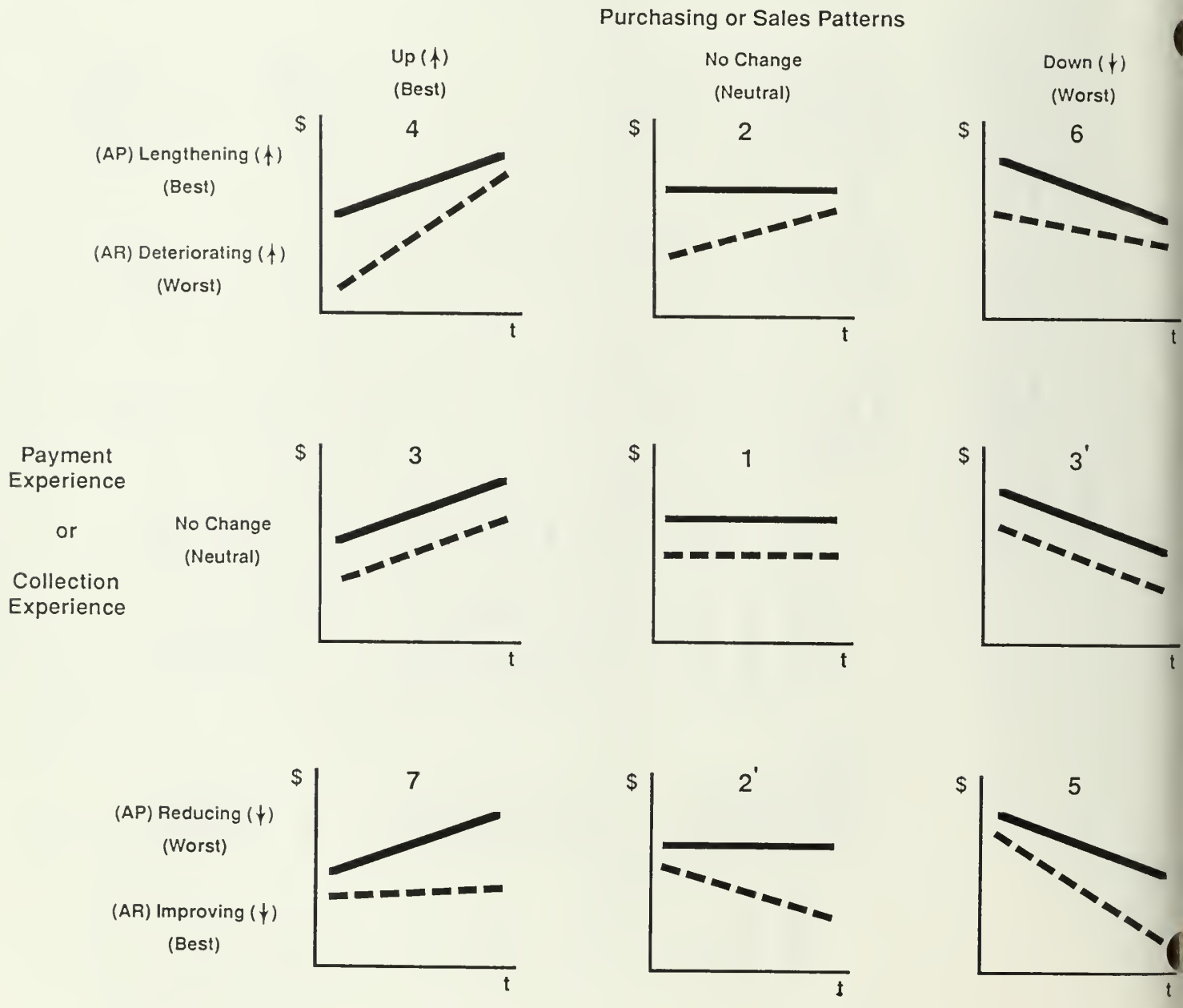
Exhibit 4

An Example of Using the Algorithms to Measure the Three Effects that Cause Changes in Accounts Payable (in millions of dollars)

Change in Payables Between Months	Period	Condition & Type of Effect	Algorithm ($ in Millions)	Purchasing Pattern Effect (PPE)	Payment Experience Effects (PEE)	Joint Effect for Payables (JEP)	Change in Payables from Exhibit 3
6-3	t-2	3/PPE	(80-90) x .10	-1			
6-3	t-1	1/NONE					
6-3	t	2/PEE	(.60-.50) x 80		8		
6-3	t			-1	8	0	7
9-3	t-2	4/PPE	(100-90) x .10	1			
		4/PEE	(.20-.10) x 90		9		
		4/JEP	(100-90) x (.20-.10)			1	
9-3	t-1	6/PPE	(90-110) x .20	-4			
		6/PEE	(.30-.20) x 90		9		
9-3	t	5/PPE	(70-80) x .40	-4			
		5/PEE	(.40-.50) x 70		-7		
		5/JEP	-(70-80) x (.40-.50)			-1	
9-3	t			-7	11	0	4
12-3	t-2	7/PPE	(100-90) x 0	0			
		7/PPE	(0.0-.10) x 90		-9		
12-3	t-1	3/PPE	(100-110) x .20		-2		
12-3	t	7/PPE	(100-80) x .40	8			
		7/PEE	(.40-.50) x 80		-8		
12-3				8	-19	0	-11

Exhibit 5

Examples of Relationships that Cause Changes in Payables and Receivables



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